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Comments:
From the SCS Chief

Efficient Irrigation Systems Conserve Water and Reduce Soil Erosion

The number of irrigated farmland acres in the United States highlights the need to properly manage the application of water on cropland fields.

More than 65 million acres of the Nation's cropland is irrigated—almost three-fourths with furrow, or flood, irrigation and most of the rest with sprinkler systems.

Many of these irrigated acres have the potential for serious resource problems. Applying too much water—or applying it the wrong way, especially on sloping fields—erodes soil and carries sediment, nutrients, and pesticides into streams, rivers, and lakes.

Researchers have measured sediment yields as high as 70 tons per acre on some furrow irrigated fields, 20 times above acceptable soil erosion levels for those particular soils.

Overirrigation can also cause water to percolate beyond the root zone into ground water and carry pollutants to underground supplies.

Fortunately, the potential also exists on irrigated lands for impressive soil and water savings. The Soil Conservation Service is helping irrigators, especially in water-short or highly erosive areas, to evaluate the efficiency of their irrigation systems and is recommending ways to improve them.

In some States SCS field employees are using mobile field water conservation laboratories to help irrigators conserve water.

Improved irrigation practices conserve and protect water as well as soil. And soil erosion is being recognized more and more as a problem not only on the farm but beyond the farm gate too.

It's estimated that soil erosion costs the United States billions of dollars a year in increased flood damage, water treatment expenses, river and harbor dredging, lost water storage and recreation capacity, and damaged fish and wildlife habitat.

SCS and other U.S. Department of Agriculture, Federal, State, and local agencies are cooperating to help farmers develop irrigation systems that are compatible with local soils, slopes, crops, water supplies, and climatic conditions.

Most importantly, any irrigation system should be part of a complete conservation plan.

More efficient irrigation systems make farmers better stewards of water as well as soil. Let's continue to help farmers conserve and protect both.

Cover: Saline seep in Liberty County, Mont. Saline seep, salty areas on nonirrigated cropland, has taken about 280,000 acres of dry cropland out of production in Montana. See article on page 8. (Photo by Tim McCabe, photographer, SCS, Washington, DC.)

John R. Block
Secretary of Agriculture

Wilson Scaling, Chief
Soil Conservation Service

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News Briefs

Off-Farm Costs of Soil Erosion Too Great to Ignore

On May 6 and 7 in Washington, DC, 160 people from 15 different environmental, conservation, and policy groups met to discuss the offsite effects of soil erosion. The Conservation Foundation, a nonprofit environmental research group, and the Soil Conservation Service cosponsored the event.

The symposium focused on the economic costs of soil erosion after sediment and associated contaminants leave farm lands.

Participants included soil scientists, hydrologists, engineers, environmentalists, wildlife biologists, and economists from universities; private industry; non-profit conservation groups; and local, State, and Federal agencies. They talked about waterways polluted by sediment and agricultural chemicals, destruction of breeding grounds for fish and other wildlife, increased expenses for dredging harbors and treating wastewater, higher riverbeds leading to greater flooding, and reservoirs and lakes silting up more quickly than anticipated.

They talked about studies of these offsite effects in different parts of the country. In New Mexico, for example, windblown soil particles "sandblast" plants and property. The windblown soil reduces visibility and clogs roadways.

A study made at Colorado State University in Fort Collins, estimates the annual offsite costs from wind erosion in New Mexico to be at least $514 million.

In Washington State researchers are studying how sediment in streams is affecting salmon fry. Nationwide, sediment-laden waters are reducing the populations of desirable sport fish and limiting recreation. This hurts rural economies.

As agricultural chemicals attached to sediment particles and nutrients like phosphorus and nitrogen enter waterways, they threaten drinking water supplies and increase municipal water treatment costs.

"The Nation can no longer afford to ignore the substantial costs of soil erosion off the farm," says a recent Conservation Foundation study, *Eroding Soils: The Off-Farm Impacts*. Its author, senior associate with the Foundation, Edwin Clark, estimates that off-farm effects of soil erosion cost the country more than $6 billion a year.

Clark says that serious problems off the farm are caused by runoff from croplands containing pesticides and other contaminants. He said that stormwater runoff from city streets and runoff from construction sites, mining operations, and other nonpoint sources also contribute to the problems.

"Increased research is especially needed to learn more about where the most serious off-farm impacts are occurring and how they are related to agricultural lands," said Clark. "It can be very difficult to determine which particular lands are responsible for an off-farm effect." Contaminants can travel great distances, sometimes over tortuous paths, doing damage along the way, as well as where they settle out, he said.

"The techniques to control soil erosion and runoff do exist and they are effective, efficient, and affordable," said Clark. They are contour plowing, conservation tillage, crop rotations, and terraces and diversions.

The best measure according to Clark is preventive. He recommends reducing the use of pesticides and fertilizers and establishing filter strips along streams to stop agricultural pollutants before they reach waterways. He also recommends taking the most seriously eroding lands out of rowcrops and targeting conservation efforts where they could accomplish the most.

Peter C. Myers, former Chief of the Soil Conservation Service and now Assistant Secretary for Natural Resources and Environment, told the group, "The primary reason SCS supported this symposium is the lack of data on offsite impacts during preparation of the 1985 appraisal carried out under the Soil and Water Resources Conservation Act of 1977—also known as RCA.

"SCS prepared the first appraisal under this legislation 5 years ago, and the lack of data on offsite effects of farm activity hampered the analysis. Many of the comments we received noted that lack."

Symposium participants agreed overwhelmingly on the need for more research on how the products of soil erosion from cropland and other lands affect the environment and the economy offsite.

"We're all working toward the same goal," Myers told the group, "and we have a lot to do. We need your talents, your perspectives, and your hard work. Collectively, we can accomplish much. Individually, it will take longer and cost much more in public funds."

The Conservation Foundation will be publishing the symposium proceedings later this year. *Eroding Soils: The Off-Farm Impacts* is available for $15 (plus $2 for handling) from the Conservation Foundation, 1717 Massachusetts Avenue, NW., Washington, DC 20036.

Nancy M. Garlitz,
associate editor, *Soil and Water Conservation News*, SCS, Washington, DC

New Model Predicts Effect of Erosion on Soil Productivity

Agricultural researchers have developed a computer model to measure the effect of erosion on soil productivity. The new model is being used for the 1985 appraisal report required by the Soil and Water Resources Conservation Act of 1977 (RCA). RCA reports are considered USDA's most authoritative guides for establishing conservation policy.

The model is the Erosion–Productivity Impact Calculator (EPIC) developed by USDA's Agricultural Research Service (ARS) with assistance from USDA's Economic Research Service and Soil Conservation Service. It is designed to fill a data gap, identified by the 1980 RCA report, on the effect of erosion on soil productivity.

EPIC simulates the interaction of the soil-climate-plant-management processes in agricultural production. It is composed of submodels for simulating weather, hydrology, wind and water erosion, plant nutrient cycling, changes in soil characteristics, tillage practices, and plant growth.

Historical weather conditions are simulated 1 day at a time, and the effect of each "weather day" is traced through the other

submodels. EPIC records the daily outputs (such as runoff, erosion, plant growth, and production) and provides a daily balance (of such components as soil moisture, nutrient levels, biomass, and residue) as input for the following day. Enough "weather days" have been fed into the model to predict the effect of erosion on soil productivity for the next 100 years.

The model allows comparisons of the effects of different management practices on yields, erosion, and fertilizer requirements. At this point in its development, EPIC cannot predict some onsite effects of erosion, such as poor seedling establishment and decreased water infiltration, or any of the offsite effects of erosion.

The development, validation, and future use of EPIC were the subjects of a 2-day forum sponsored by the three USDA agencies during May in Washington, DC. The forum was attended by approximately 85 scientists, engineers, economists, computer specialists, and others involved with agricultural research and policy analysis.

The first nationwide application of EPIC will be for the 1985 RCA report. To date, the model has calculated erosion rates for as many as 13,000 different combinations of soil types, tillage practices, conservation practices, and conservation structures on about 1,100 locations across the Nation. EPIC will predict how much yields are reduced even if additional fertilizer is applied and how much extra fertilizer must be applied to compensate for the nutrients removed by erosion if current (or predicted) erosion rates are allowed to continue.

According to preliminary data presented at the forum, fertilizer can compensate for all of the loss of productivity in some soils. In other soils, erosion will irreversibly destroy the productive capability. Based on 1982 rates, water erosion alone will irreversibly damage the productive capacity of about 22 percent of the Nation's cropland by the year 2080.

Much of the pioneering work on EPIC was done by Jimmy Williams, hydraulic engineer with ARS. Williams and a team of 12 researchers from the three agencies have been working on EPIC since 1981. SCS provided much of the data used by EPIC, and SCS State offices assisted in selecting the test sites. Some applications of EPIC can now be performed on personal computers.

Additional information about EPIC can be obtained from Wes Fuchs, SCS soil scientist assigned to the Grasslands Soil and Water Research Laboratory, ARS, P.O. Box 748, Temple, Tex. 76503. The proceedings of the forum are to be published and can be obtained from Jim Maetzold, Appraisal and Program Development Division, SCS, P.O. Box 2890, Washington, DC 20013-2890.

Boy Scout Councils Win Conservation Awards

Not only is 1985 a special year for soil and water conservation, marking the 50th anniversary of the soil and water conservation movement, it is also a special year for Boy Scouting: the 75th anniversary of the establishment of Scouting in the United States. In addition, 1985 is the 25th anniversary of the U.S. Department of Agriculture's Council Conservation Awards program.

To recognize these special anniversaries, the National Boy Scout Conservation Committee approved the issuance of a one-time-only Silver Anniversary Council Conservation Award. The honoree must have clearly demonstrated a sustained, high-quality conservation and youth involvement program. The winner of the Silver Anniversary Conservation Award is the General Herkimer Council, Herkimer, N.Y.

This council has established an enviable record of cooperation and involvement among local, State, and Federal agencies; conservation and environmental organizations; and concerned citizens. With this assistance, a long-range plan for Camp Russell, the council's summer camp, was developed.

The multi-disciplinary resource plan includes a comprehensive forestry management program, soil and water conservation plan, and outdoor recreation and education plan. Through implementation of the plans' provisions, the council has previously been named twice as winner of USDA's Gold Seal Award, and once as the Green Seal Award winner. In addition, it has been honored by the New York State Conservation Alliance and the Eastern Loggers Association. Not only has the General Herkimer Council achieved an enviable record of on-the-land conservation and resource management, but its Scouts have also earned nearly 4,400 nature and conservation related merit badges in the past 25 years.

Clearly, the General Herkimer Council is a special council and represents the highest ideals of both Scouting and natural resources conservation.

The 1984 U.S. Department of Agriculture Gold Seal Award for the best conservation program went to the East Carolina Boy Scout Council, Kinston, N.C. Five other councils received Green Seal awards. Since 1960, USDA's Soil Conservation Service and Forest Service have jointly sponsored the annual awards to councils with outstanding conservation programs.

The East Carolina Council, with the cooperation of the North Carolina Division of Forest Resources, produced a woodland management plan for all its properties. In addition, an extensive list of conservation projects is developed in early summer for use by the Ecology–Conservation Department of the Council's Summer Camp. The projects are carried out by merit badge classes during the camp season and by troops during their stay at camp. The list is expanded and used during fall, winter, and spring by the many troops that camp on the properties during the off-season.

The project list includes: erosion control on trails; clearing fire lanes and putting brush into wildlife brush piles; riverbank stabilization; and building animal habitats, such as duck boxes and birdhouses. In areas where heavy foot traffic was causing erosion problems, Scouts built walkways, bridges, or stairways.

Green Seal awards went to the following councils: Philadelphia Council, Philadelphia, Pa.; Peninsula Council, Newport News, Va.; Monterey Bay Area Council, Salinas, Calif.; Uwharrie Council, High Point, N.C.; and Chief Cornstalk Council, Logan, W. Va.

Thomas W. Levermann,
public affairs specialist, Public Information Staff, SCS, Washington, DC

Townspeople Give Lake New Lease on Life

by Nancy M. Garlitz

Something was wrong. The water in the lake wasn't as clear as it used to be. The water smelled and tasted bad. In the summer, widespread algae blooms were bothersome to boaters, fishermen, and swimmers. Something was clearly wrong.

In 1973, scientists at the Connecticut Agricultural Experiment Station named the problem. They said that Lake Waramaug was eutrophic, or dying.

Some say that recognizing a problem is half of the problem solved. That proved to be the case when lakeside residents and residents of the three townships that border the lake learned of the situation.

Since then they've worked together to install soil conservation practices and an innovative in-lake pumping system that have literally given the 672-acre Lake Waramaug in the hills of northwestern Connecticut a new lease on life.

Lake Waramaug

Lake Waramaug, the State's second largest natural lake, borders on Washington, Warren, and Kent Townships in Litchfield County. The 86-acre Lake Waramaug State Park lies along the lake's northwestern shore.

The recreation value of the lake plays an important role in the economy of the area. The lake and its surroundings attract 140,000 visitors annually. They come for swimming, water skiing, sailing, rowing events, fishing, picnicking, and camping.

There are four lakeside inns, a country club and golf course, and two town beaches. There are about 170 private residences within 400 feet of the lakeshore.

Eutrophication

Eutrophication is the enrichment of a body of water by nutrients and organic matter and filling-in by sediments. It is a natural aging process occurring in all lakes.

A eutrophic lake is characterized by high concentrations of plant nutrients and dissolved materials, excessive algal production and other aquatic plant growth, oxygen depletion in the deeper bottom water, and discolored and turbid water with a bad taste and odor.

As a lake becomes more productive, more organic matter from dead plants and algae and other organic wastes sink and settle on the bottom. Bacteria decompose the matter, consuming oxygen in the process.

The animals that live in the bottom water use oxygen, and plants use it in night-time respiration. Soon, the oxygen supply, typically low in bottom water, becomes depleted and fish kills may result.

Eutrophication is usually a very gradual process and can only be measured on a geologic time scale. However, human activities in a watershed can greatly accelerate the natural process.

Lake Waramaug Task Force

In August 1975, residents from the three towns that border the lake formed the Lake Waramaug Task Force to see what could be done to make the lake healthy again. The task force of about 15 people works on a volunteer basis to help residents understand the lake's problems and find ways to help solve them.

In August 1976, the task force arranged for the King's Mark Resource Conservation and Development Area Environmental Review Team to make an inventory and evaluation of conditions in the lake and its watershed. Following the team's report, in 1977, the task force worked with the Northwestern Connecticut Regional Planning Agency (NWCRPA) and the Water Resources Division of the U.S. Geological Survey (USGS) on a special study of the lake and its 14-square-mile watershed.

The NWCRPA received a grant to administer the study from the U.S. Environmental Protection Agency (EPA) under Section 314 of the Clean Water Act. The Water Resources Division of the USGS did the water testing. The agency collected data on precipitation, surface water inflow from streams, ground water inflow, and inlake conditions.

The Lake Waramaug Task Force raised $20,000 from area residents to pay half of the cost of the USGS water tests.

Water Quality Testing

A precipitation gauge near the lake collected samples of rainfall each month, which were analyzed for specific conductance, pH, nitrogen, and phosphorus.

The water quality of streams, brooks, and roadside ditches that flow into the lake was monitored at 25 sites and sampled at four different times between spring and fall. Each of these sites was monitored for streamflow, specific conductance, pH, dissolved oxygen, water temperature, bacteria content, suspended sediment, dissolved solids, organic carbon, algal growth potential, and nitrogen and phosphorus.

Ground water flowing into the lake was sampled during the summer months for nutrient content. Specially designed collector traps were set in the lake in areas where ground water flows through the lake bottom sediments. Water samples were also collected from selected wells and springs from near the shore and upland areas.

Lake water was sampled every 3 weeks at 16 different locations. Inlake measurements were taken of temperature, dissolved oxygen, specific conductivity, and pH at various depths throughout the water column.

At each site a secchi disk, a circular metal plate, was used to measure the depth of light penetration. The purpose of the inlake testing was to depict the changes that occur in the water body over the seasons of the year when the lake is free of ice.

Water samples were analyzed for nitrogen, phosphorus, alkalinity, organic carbon, phytoplankton, and algal growth potential. In addition, bed material samples were taken from the upper few inches of the lake bottom at 13 sites within the lake and analyzed for nutrient content.

Watershed Management Plan

Besides water testing, the Lake Waramaug special study included an investigation of the various land uses and practices within the watershed for existing and potential sources of nutrient flow to the lake. The objective was to develop a realistic long-term land and water management plan for the towns surrounding the lake.

"Our main goal," said Janet Bates, chairperson of the Lake Waramaug Task Force, "was to reduce the sediment and nutrients reaching the lake and slow down the rate of eutrophication." The task force worked with the towns and other government agencies, including the Soil

Conservation Service, in developing an overall watershed management plan.

The watershed area is about 9,034 acres, most of which is in the town of Warren. Much of the watershed is forested or classified as wetland. Major land uses are recreation, housing, commercial development, and farming. About 10 percent of the watershed is in corn, hay, and pasture land.

Litchfield County SCS District Conservationist Arthur Cross worked with farmers in developing conservation plans that included concrete-lined manure storage pits, a winery waste lagoon, conservation tillage, and cover crops. Landowners received financial assistance for construction of some of these practices from the Agricultural Stabilization and Conservation Service and EPA.

In addition to reducing the sediment and other pollutants leaving farm fields, the management plan included measures that lakeside residents could take to reduce pollutants washing off their property. The task force, with technical assistance from the Extension Service, EPA, SCS, and others, conducted workshops for homeowners on properly fertilizing yards, growing a grassed barrier or filter strip between their land and the lake, properly disposing of grass clippings and other organic wastes, using nonphosphate detergents, properly cleaning septic systems, and other practices.

The task force worked with the Connecticut Department of Transportation on improving road drainage and reducing roadside erosion to reduce sedimentation.

Shoreline and Streambank Stabilization

"Lake Waramaug is long and thin," said Cross. "Power boats on the lake created wave action that had eroded the shoreline and damaged or felled trees by undercutting the soil beneath them. This kind of shoreline erosion was most serious along the State park land. Silt loads from the erosion problem contributed to the excessive nutrients in the lake and ultimately to algae blooms."

Through the Resource Conservation and Development (RC&D) Program of the U.S. Department of Agriculture, SCS provided technical and financial assistance in stabilizing 2,885 feet of eroding State park shoreline, with a combination of riprap and precast concrete cellular blocks. The blocks were filled with topsoil and seeded. This engineering practice was perfected in Holland.

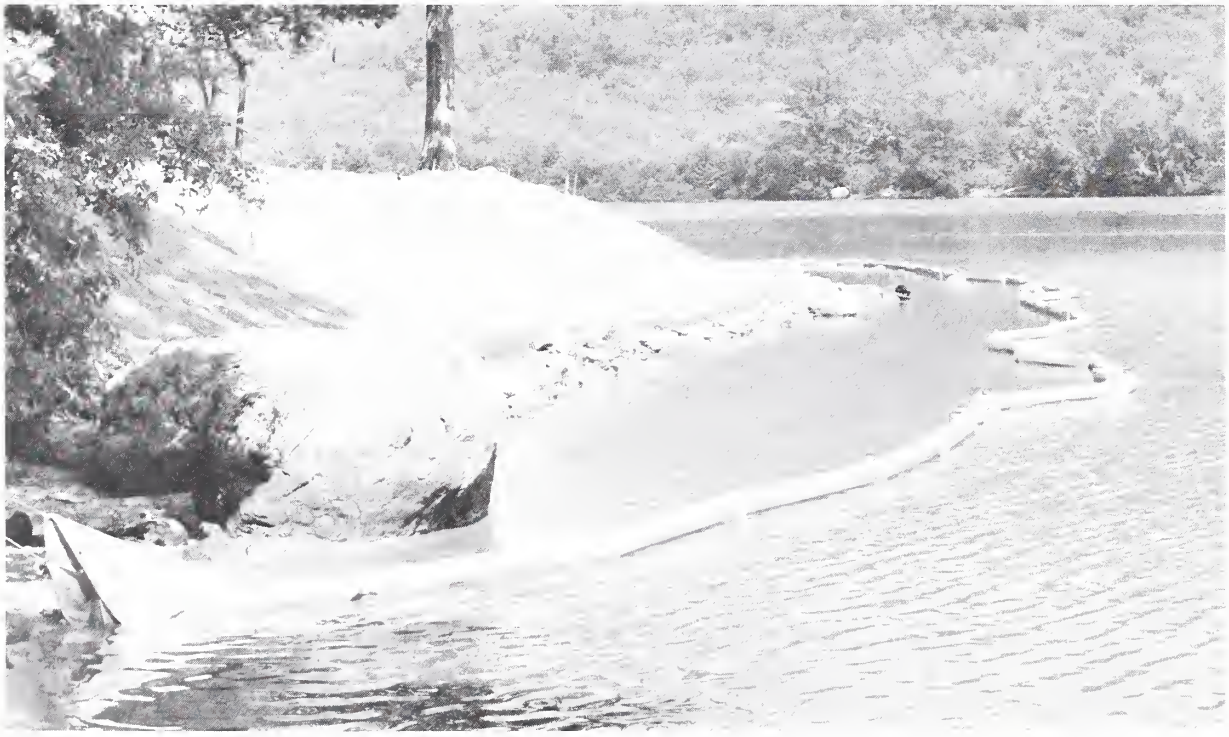
RC&D work also included applying critical area treatment along Sucker Brook, and constructing three sediment basins on Sucker, Potash, and Hawes Brooks.

The sediment basins and associated streambank stabilization cost $77,000 and were completed in 1981. SCS paid 75 percent of the cost and the task force made up the difference.

The shoreline stabilization, which included other measures, was completed in May 1985 and cost $268,000. The State paid 38 percent of the cost and SCS paid the rest.

Pollution From Lake Bottom Sediments

"As conservation work in the watershed and water quality monitoring continued, it became clear that excessive nutrients, especially in summer months, were coming not only from the watershed," said Thomas McGowan, director of the Lake Waramaug Task Force. "We discovered that they were coming from the lake bottom sediments as well.



A floating silt barrier made of permeable filter fabric and weighted at the bottom held sediment in a small area close to shore until stabilization work was completed and vegetation established along part of the Lake Waramaug shoreline.

"As dead plant and animal material falls through the water column, it begins to decompose," said McGowan. "This decomposition uses up oxygen. Because all of the decomposing matter eventually falls to the bottom of the lake, the oxygen is used up rapidly in the deep water. When the lake stratifies, no new oxygen can be introduced from the well-oxygenated surface water and the deep water becomes anoxic, or without oxygen."

A chemical reaction known as "reduction" then takes place, releasing nutrients in the sediment such as phosphorus into the overlying water.

Hypolimnetic Withdrawal System

To reduce the amount of phosphorus being released from lake bottom sediments in summer months, the task force enlisted the help of Robert Kortmann, a limnologist or person who studies lakes. Through a grant from the Jessi Noyes Foundation in New York, Kortmann worked with a private engineering firm in designing a hypolimnetic withdrawal system for the lake.

In a hypolimnetic withdrawal system water is pumped from the hypolimnion or lowest level, aerated, and put in a retention basin for further aeration. The treated water is then discharged into a lake or river.

The system that Kortmann designed for Lake Waramaug consists of two inlake treatment sites. One draws water from the two central basins of the lake and discharges it into the northwest basin. The other draws water from the southeast basin of the lake and discharges it into the East Aspetuck River.

At each site, water is pumped from the top of the nutrient-rich, anoxic bottom layer of the lake, sent over aeration flumes to oxygenate it, and retained for 32 minutes at the site that discharges into the river and for 2 hours at the site that discharges into the lake.

The water that is sent back to the lake is returned to the top of the cold, anoxic bottom layer. There the oxygenated water in effect seals the lake bottom sediments, preventing the release of phosphorus and other nutrients into the warm surface water where they would promote algal growth.

The site that draws water from the lake and discharges it into the river continually skims the nutrient-rich layer of water from the top of the hypolimnion to prevent it from mixing with the surface water.

Pulling water from the bottom layer creates a boundary between the cold bottom water and the warm surface water. This thermal barrier also limits the upward movement of nutrients.

Janet Bates says that similar in-lake systems are being used in Lake Wononscoponuc in Salisbury, Conn., and in Germany and Poland but are not widely used in North America. Materials and installation of the two treatment sites cost $350,000. EPA provided cost-share funds and many townspeople and businesses donated their labor and materials to the project.

Construction began in October 1982, and the pumping systems began operating in May 1983. The systems are run from spring to fall. Based on each town's portion of the lake shoreline, Washington, Warren, and Kent appropriated a total of $18,000 in their 1983-84 budgets to pay for the operation and maintenance of the systems by an interlocal commission.

Results Promising

"Soil erosion and pollution control measures are reducing the amount of nutrients washing into the lake," said McGowan, "and the inlake pumping system is slowing the release of nutrients from the lake bottom sediment." The former helps reduce algae blooms in the spring and the latter in the summer.

Data gathered during the summer of 1983 showed that the phosphorus concentration in the surface water was reduced by 60 percent for most of the summer. The two most obvious improvements were fewer algae blooms and clearer water. Based on data from European hypolimnetic withdrawal systems and the one in Lake Wononscoponuc, the increase in lake water quality is expected to be cumulative over about 5 years.

Watershed Controls Still Needed

"But the danger has not passed," said McGowan. "Housing development, road construction, logging, drainage projects, or other changes in the watershed can alter the delicate balance of the lake ecosystem. It is more important now than ever to continue to protect our investment with comprehensive watershed management."

Community Spirit

The Lake Waramaug Task Force has successfully sought and coordinated the technical and financial assistance of several Federal, State, and local agencies to give the lake a new lease on life.

EPA has provided more than $400,000 in grants that have been matched dollar for dollar by State agencies and local people who have contributed $200,000 and many hours of their time to the project. "Key to the task force's success has been the cooperation and generosity of the local people," said Bates.

In 10 years a small group of concerned people have rejuvenated a 672-acre lake through a combination of community cooperation and dedication to a common cause. They have adopted an innovative method of lake restoration that may serve as a model for curing eutrophic lakes nationwide.

Nancy M. Garlitz,
associate editor, *Soil and Water Conservation News*, SCS, Washington, DC

Seep Control Across Montana

Wet, salt-covered soil. Montanans know the signs well. Saline seeps have taken about 280,000 acres of dry cropland out of production across the State.

But farmers and ranchers aren't waiting for help. They are taking action to stop the growth of seeps on the landscape.

The most publicized effort in recent years has been the Triangle Conservation District saline seep control team in the Triangle area north of Great Falls. (See articles in the September 1980 and September 1981 issues of *Soil and Water Conservation News*.) Other Montana conservation districts are now working on saline seep control through special projects.

Saline seep—salty areas on nonirrigated cropland—is caused by water filtering below the roots of plants, hitting an impervious layer of rock or shale, and moving laterally until it resurfaces with salts from the soil.

To reclaim seeps, the moisture must be used where it falls. Most scientists agree that seeding alfalfa or an alfalfa-grass mixture is necessary to lower existing high water tables. Once the water table is drawn down, they also advocate using a recropping system with small grains to use more of the available moisture.

The Triangle Conservation District was originally an umbrella organization for 10 conservation districts. The district hired a four-member team to work with farmers and ranchers in the nine-county area. The last four State legislatures funded the Triangle Conservation District, and 24 more counties have joined the effort.

In northern Liberty County, the Liberty County Conservation District and Big Sage Creek Alkali and Water Quality Association are sponsors of a land treatment watershed project. Over the next 15 years, the Soil Conservation Service will provide technical and financial assistance to landowners in the area through long-term contracts, which will cover conservation practices and management needed to control saline seep. Without the project SCS estimates that there are 10,400 acres of potential and existing seeps in the Sage Creek watershed. With the project, the seeps will be limited to 2,300 acres.

SCS is funding demonstration areas in the Stillwater Conservation District in south-central Montana and the McCone County Conservation District in northeast Montana. In late summer of 1983, each district identified a landowner with a seep problem who agreed to use conservation practices and management necessary to control the seep. These demonstration areas will be used to show local farmers how seeps have been controlled in other parts of Montana.

Brad Anseth,
public affairs specialist, SCS, Bozeman, Mont.

At left, a saline seep in the last stages of formation has white salt crusts on the surface. The wet, salt-covered soil won't grow anything.

At right, landowner Rudy Cicon measures water in a monitoring well in a saline seep discharge area to gauge the effectiveness of treatments he installed to reduce saline seep.

Photos by Tim McCabe, photographer, SCS, Washington, DC.

Project Keeps Heavy Metals Out of Montana Stream

A Resource Conservation and Development (RC&D) project has been completed in southwestern Montana to improve water quality. The project in the Headwaters RC&D area was designed to keep heavy metals from entering Grasshopper Creek, which flows through Bannack, Montana's territorial capital and early mining camp, and eventually joins the Beaverhead River, a prime Montana trout stream.

The heavy metals—lead, copper, zinc, arsenic, and mercury—were washing into the creek from abandoned mine milling tailings. To keep the creek banks from eroding into the area of mine tailings, 1,400 feet of rock riprap was installed in three sections. A 1,400-foot diversion was also installed to keep rain and snowmelt runoff from flowing across the tailings, picking up the heavy metals, and draining into the creek.

Before the RC&D project, there were no fish in Grasshopper Creek just below the area of tailings, and, according to a 1970 study by the U.S. Environmental Protection Agency, fish further downstream exceeded Food and Drug Administration (FDA) guidelines for mercury.

Recent fish tissue analysis by the Montana Fish, Wildlife, and Parks (FWP) revealed that no fish exceeded the FDA guidelines for mercury. According to Glenn Phillips, pollution control biologist for Montana FWP, since the project was completed, biologists from his agency have observed insect species considered sensitive to heavy metals in Grasshopper Creek just below the tailings. "It appears that since the RC&D project was completed, there has been considerable improvement in heavy metals control," Phillips said, "but the overall effect on the fish population has yet to be evaluated."

The Beaverhead Conservation District and Montana FWP sponsored the project and paid for 25 percent of the construction costs. The Soil Conservation Service provided the engineering assistance and the rest of the construction costs.

Earl Love,
retired district conservationist, SCS, Dillon, Mont.

Recropping Benefits Montana Farmers

A northeastern Montana family is convinced that some recropping pays for itself and protects the soil resource more than the alternate crop-fallow system.

Gordon Holte and two sons, Jamie and Tim, farm near the Canadian border north of Plentywood. In the last 10 years they have increased the amount of land they recrop from 10 percent to 40 percent.

"We think we are growing more grain than we would with crop-fallow," Gordon explains. "And even if we didn't, we would sacrifice some yield and do as much recrop as possible—just to gain the advantage of soil protection and reduction of saline seep areas."

The Holte records show that yields on recrop have been 60 to 70 percent of those on summer fallow.

"In a 5-year period there is probably more total yield," Jamie says. "There is some quality problem, the protein is down, but we hope this can be controlled with fertilizer."

The Holtes are one of northeastern Montana's leading proponents of recropping because they are satisfied with the yield and because it rebuilds and protects the soil. They are serious conservationists and are worried about the future of farming.

"If people are going to keep farming in a semi-arid region, they have to go to a recropping system—at least on part of their land," Gordon insists. "Especially where there is some wind erosion, but definitely where there are slopes and water erosion.

"This soil moves when there is a thunderstorm with hard rain," Gordon says. "You can see the difference in runoff between recrop and fallow. Watching fallow almost hurts. You can see the soil move."

Jamie and Tim make most of the decisions on the 2,200-acre operation now. "We try to have cover on the land 4 out of 5 years," Jamie says. The crops include spring, Durum, and winter wheat; safflower; and barley. "There is no definite set order to the cropping," Jamie says. "We are still experimenting and trying new ideas. Our decisions are limited by past crops, fall rains, weed problems, stubble, and government programs."

Gordon adds, "We don't use soil moisture as the final answer as to whether to recrop. Success of the crop very often depends on the rain in the summer. Recrop is sometimes necessary to avoid large blocks of fallow."

One of the Holtes' goals with the recropping system is to keep maximum cover on the ground. "Stubble is not worked in the fall except to seed," Jamie says. In the spring they spray to control broadleaf weeds. They work the ground only enough to incorporate other chemicals and fertilizers, unless these are fall applied.

Jamie and Tim try to limit summer fallow cultivation to two or three times while the county average is about five tillage operations. Of course, chemicals are used for weed control on growing crops.

The Holtes are still evaluating chemical fallow. "Chemical fallow might be a desirable practice," Gordon admits. "If it is, then the greatest value will be in keeping cover on the ground by reducing cultivation."

Gordon doesn't think chemical fallow is needed to increase the amount of water entering the soil. "Research agencies tell us that only a fraction of the precipitation during a 21-month fallow season is used to grow a crop. The excess moisture causes erosion or saline seep."

Harrow is a nasty word on the Holte farm. It breaks down the straw and eliminates a lot of soil protection. Gordon and his sons say they would rather work fallow one extra time than use the harrow.

"It's only occasionally in the spring that a harrow attachment will be used just before seeding. With a press drill we get ridges for erosion protection or we would not use a harrow," Gordon says.

The Holtes use a furrow drill with 9-inch spacing for seeding. "It works well in stubble and hard ground," Gordon says. "The wide spacing, however, presents two problems: one, you don't get a dense crop cover to control weeds; and two, if the grain is swathed, the windrows sometimes drop between the rows of stubble."

The Holtes have considered using an air seeder behind the cultivator, but they know they will lose packing action and may have a depth problem.

For the recrop to work, fertilization is a

must. "Don't think about recrop without thinking about fertilization," Gordon cautions. That means a soil test in the fall. But the Holtes have found even when they fertilize up to the recommendations, recrop reacts differently than summer fallow.

As part of their fertilization trials, the Holtes are testing legumes—sweet clover or alfalfa—to see if they can replace commercial fertilizers. The Holtes plan to leave the legume in for 2 or 3 years, not hay it, then plow it up.

"We would like to have 10 percent of our land in legumes all the time," Gordon says. Now they have about 5 percent.

The Holte's economic analysis of recropping and crop fallow concludes that recropping is profitable.

"By eliminating summer fallow," Jamie says, "which is getting more expensive, I think recropping is profitable." Gordon readily admits there is a tremendous amount of management necessary in recropping. The Holtes also admit they have more questions than answers.

Spring is a hectic time on the Holte farm. The Holtes are trying to work in winter wheat to eliminate some spring seeding. They have had success in seeding winter wheat into stubble. They think the stubbled-in winter wheat may reduce the winter kill which is prevalent with winter wheat seedings in summer fallow in the area.

"I have also tried seeding spring wheat late in the fall—November 15—late enough so it doesn't sprout until spring," Jamie says. It did very well in stubble. The Holtes have had problems with spring wheat planted in the fall penetrating through a crusted soil surface in the spring.

While there are problems in the recropping, the Holtes feel it is well worth it just from a soil conservation point of view. "You have continuous cover on the soil with recropping. We also hope the practice will start to improve the land because of the organic matter created each year," Gordon says.

"And it's hard to place a dollar value on that," Jamie adds.

Brad Anseth,
public affairs specialist, SCS, Bozeman, Mont.

Montana Rancher Fences Creek to Slow Erosion

When Joe Jepson, a rancher in Townsend, Mont., originally went to the Soil Conservation Service for help, he was just looking for recommendations for seeding grasses. That was 6 years ago, the spring after he and his father John bought a ranch in Deep Creek Canyon.

Today, as a cooperator with the Broadwater Conservation District, Jepson is finishing up a Great Plains Conservation Program contract that has given him technical and financial help to do soil and water conservation work on the 1,030-acre ranch.

He explains that when he bought the ranch, "there was no area that didn't need attention."

One of his early projects was fencing both sides of a creek that winds through his property. Originally he planned to fence only one side of the creek, mainly to get better livestock distribution on his irrigated pasture; but, as Jepson explains, during a flood one spring "the creek went wild and that made me think about another cross fence." The high waters almost destroyed his irrigation pump site.

The fencing kept the cattle off the saturated streambanks, eliminating some sloughing and allowing brush to reestablish and stabilize the banks.

According to SCS District Conservationist Mike Crowell, SCS discourages spraying of brush and farming right down to the streambank. "These two practices accelerate streambank erosion," Crowell said.

Jepson noted that fencing has some other benefits. Keeping cattle out of the stream corridor will control the spread of weeds and will improve wildlife habitat.

The creek is still the prime livestock water source for two pastures. Jepson fenced a 30-foot corridor across the creek for livestock water and for a moving lane. He graded and riprapped this section.

Jepson's concern for reducing erosion on the creek was part of a larger plan he had for the ranch. "I thought the Great Plains Conservation Program fit me," said Jepson. "I could write out a plan to do what I needed to do in 3 to 5 years."

Instead of one large pasture, Jepson ended up with three dryland and two irrigated pastures. His goal was to run 100 to 200 head of yearlings. As part of that goal, he has seeded 100 acres of dryland grain to alfalfa and pubescent wheatgrass, rested his rangeland for 2 years, and developed a well to bring stockwater to three of the five pastures. He recently added another fence and stockwater well and a stockwater tank to his contract, practices he plans to install this year.

Once those improvements are in place, Jepson will implement the planned rotation grazing system on the ranch. He knows it will take time to improve the soil and water resources, but he has already seen the improvement and plans to continue his work.

Brad Anseth,
public affairs specialist, SCS, Bozeman, Mont.

Sedimentation of Reservoir Leads to Soil Conservation

Farmers in southeast Idaho are working to keep their soil up on the farm—not down in a reservoir.

When Daniels Reservoir was built for irrigation water storage northwest of Malad in 1967, its projected lifespan was 100 years. This reservoir is filling up so fast with soil eroded from the farms in its watershed, however, that its original storage capacity of 8,788 acre-feet of water will be half gone in another 14 years.

If allowed to continue, current erosion rates will have an impact not only on the farmers in the area but also on the many local residents who enjoy the excellent sport fishing the reservoir provides. It's not uncommon for trout caught in the reservoir to weigh 5 to 7 pounds.

"The loss of the reservoir would have an impact on every person who lives in the county," said Grant Jones, a supervisor for the Oneida Soil Conservation District. "It has the potential of affecting our local economy and tax structure."

An irrigation company provides water from the reservoir to farmers who irrigate cropland. Loss of this water supply would limit the number of acres the farmers can

irrigate or force them to find other, more expensive sources of water.

For the farmers in the watershed above the reservoir, the problem translates into soil and fertility losses as well as financial losses. These farmers are losing their soil at an average rate of 12 tons per acre per year. On steeper slopes, the average annual soil loss is about 30 tons per acre. It's estimated that erosion has reduced dryland wheat production in the watershed by 14 to 18 bushels per acre.

Sediment has been visible in the reservoir for several years, but the alarming rate at which it is being deposited didn't surface until the Soil Conservation Service conducted a study at the request of the irrigation company. SCS personnel found high erosion rates on the 28,000 acres of nonirrigated cropland in the watershed. They estimated that erosion strips 340,000 tons of soil from the watershed each year, and that about 70 percent of this soil ends up in the reservoir.

A number of factors contribute to the high erosion rates. Because the soils in the area are made up of volcanic ash and silt loams with some clay, they have little cohesion and are highly erodible when saturated with water. They are especially vulnerable early in spring when winter snowpack melts and during summer when localized thundershowers drop large volumes of water on bare fields.

Many of the farmers in the watershed grow grain crops in the spring and fall using a clean-tillage summer-fallow system in which nearly all crop residue is tilled under, leaving the soil bare and unprotected. A common practice is to use disks that bury 50 percent of the stubble the first time over the field. Some fields are disked two or three times more to control weeds.

"Another problem," said John Grubb, SCS district conservationist, "is that much of the land being farmed is marginal. It should never have been broken out to begin with; it's just too steep. This makes the conservation job much more difficult."

Since the SCS study was completed in 1981, several agencies have been working jointly with farmers to reduce the soil loss in the watershed and the sedimentation in the reservoir. Through the conservation district, farmers in critical areas receive cost-sharing funds and technical assistance for installing and maintaining certain conservation practices. The funds come from a State water-quality program administered by the Idaho Department of Health and Welfare's Division of Environment and the Idaho Soil Conservation Commission. SCS provides the technical assistance.

According to Grubb, most of the erosion problem could be controlled by stubble mulching, terracing 4- to 12-percent slopes, and subsoiling to break up tillage pans. Other practices recommended for the area include conservation tillage systems, cross-slope or contour farming, diversions, waterways, and debris basins.

Erosion can be reduced on some of the farms simply by abandoning the practice of leaving crop fields fallow in summer. This practice leaves the soil unprotected and, according to Grubb, isn't necessary because there is enough soil moisture for annual cropping. The watershed receives about 15 inches of rainfall each year and has a growing season of 70 to 90 days.

Many farmers have become aware of the erosion problem and are conscientiously applying conservation practices. Jones, the district supervisor, has built terraces on his steeper slopes. "I figure I can farm cheaper with terraces on the contour because I don't have to fill in rills or gullies on my fields," he said. Jones also tries to keep 1,500 pounds per acre of crop residue on his land.

Karine Hill is another landowner in the watershed who believes in terraces. She has built 20,592 feet of terraces on the steeper slopes of the 600 acres she leases out each year and specifies in the lease that the renter must use stubble mulching.

Hill, who has been pursuing her conservation program for about 8 years, used to live in the watershed. She can remember severe floods in the Daniels area when summer rainstorms swelled small mountain creeks out of their streambeds.

"The rains and floods just pulverized the soil," she said. "Then the wind would blow for days—similar to the Dust Bowl. I'd have inches of dust in my house. That's when I realized the soil had to be protected."

Another district supervisor in the watershed, John Hill, has terraces and practices stubble mulching on his cropland. As a result, his farm sustained little erosion damage during a recent intense rainstorm that scarred many of his neighbors' fields.

According to Grubb, these conservation farmers—and others like them—are the best tool he has for convincing other farmers to help protect the soil in the watershed and the water supply in the reservoir. "I don't sell terraces," Grubb said. "Farmers who are pleased with them do."

Sharon Norris,
public affairs specialist, SCS, Boise, Idaho

Clean tillage and steep slopes are a bad combination in the Daniels watershed area. Some farmers disk their fields immediately after a storm to hide the signs of erosion, but some telltale signs remain.

New Publications

Soil Conservation in America: What Do We Have to Lose?

Prepared by the American Farmland Trust

After a 2-year study, the American Farmland Trust (AFT) has concluded that soil erosion, one of America's most serious environmental problems, can be substantially solved at a reasonable cost within the decade. A steering committee comprised mostly of farmers, ranchers, representatives of agribusiness, and conservationists met with AFT staff members to discuss and review every aspect of the study.

A key element of this study involved indepth interviews with almost 700 farmers and ranchers in six counties in the Midwest and Great Plains. Research involved previously unpublished analysis of recent information on soil erosion, conservation measures, and USDA conservation programs. AFT commissioned to have 22 technical papers written to broaden the information background for this analysis.

The publication concludes with AFT's 23 recommendations. They are grouped into the five following categories: (1) toward a national policy for agricultural resource conservation, (2) identifying soil conservation needs and opportunities on cropland, (3) coordinating conservation and commodity programs, (4) improving resource information and conservation programs, and (5) improving State and local conservation efforts.

This 133-page publication is available for $7.95 (plus postage and handling) from American Farmland Trust, 1717 Massachusetts Avenue NW., Washington, DC 20036.

Conservation Tillage: Things to Consider

by the U.S. Department of Agriculture

This 23-page publication is designed to help farmers decide how conservation tillage practices can be used in their farming operations. The booklet defines six basic conservation tillage systems and explains their advantages and disadvantages. It goes on to explain the costs in converting to conservation tillage, its effect on crop yields and soil erosion, how it works in various soils, and its effect on pest control. Highlights of research underway on problems associated with some practices are discussed.

For a copy of *Conservation Tillage: Things to Consider* (Agriculture Information Bulletin 461), send $1.50 to Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

Conservation Tillage—Strategies for the Future

Edited by Hal D. Hiemstra and Jim W. Bauder

In an effort to provide an opportunity for discussion of key issues and implications of the rapid adoption of conservation tillage, more than 60 public and private sector groups sponsored the first national conference on conservation tillage. Held in October 1984, the conference attracted more than 800 participants from throughout the United States and some foreign countries. Participants included farmers, agribusiness people, scientists, educators, professionals in government and agriculture policy, and representatives from environmental and other public interest groups.

Participants were divided into four groups. Each group attended sessions on production technology, ecological issues, economics, and public policy. Each group was asked to discuss and write down questions for the speakers to answer and to record emerging conservation tillage issues identified by the group. The outcome of these sessions revealed a concurrence of opinion about key issues in each of the four topical areas.

These proceedings include the summaries of each of the group sessions; the keynote address given by Secretary of Agriculture John R. Block; two executive summaries of other presentations; and closing comments.

Copies of these proceedings are available for $2 (third-class mail) from Conservation Tillage Information Center, Executive Park, 2010 Inwood Drive, Fort Wayne, Ind. 46815.

Missouri No-Till Forage Guide

This 4-page guide has been published to provide detailed information to farmers for establishing no-till alfalfa and clovers. After giving the definition of no-till, the guide explains several renovation fundamentals needed to succeed with no-till. Color photographs and tables help illustrate and further explain the text.

Single copies of *Missouri No-Till Forage Guide* are available free (additional copies are 30¢) from Wright County Soil and Water Conservation District, P.O. Box 187, Hartville, Mo. 65667.

Computers on the Farm

by Deborah Takiff Smith

The U.S. Department of Agriculture has published this booklet to tell farmers how computers can help them farm better, how to select computer equipment and programs, and what information is available to them through the computer.

It discusses ways in which computers can assist in farming operations such as scheduling irrigation, keeping animal and crop production records, helping with tax records and making out income tax returns, keeping machinery inventories and depreciation schedules, and keeping profit and loss records.

There is a section on information available online from USDA, State, and private sources which includes information on news, weather forecasts, crop and livestock production, and marketing.

Computers on the Farm (Farmers' Bulletin Number 2277) is available for $1.75 from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

Recent Soil Surveys Published

by the Soil Conservation Service

California: Marin County.
Florida: Bay County.
Illinois: Lee County.
Indiana: Jefferson County and Ripley and Jennings Counties.
Iowa: Hardin County and Pocahontas County.
Kansas: Osage County.
Kentucky: Anderson and Franklin Counties.
Missouri: Cass County, Christian County, Gentry County, and St. Genevieve County.
Nebraska: Rock County.
New Mexico: Catron County.
Ohio: Athens County, Jackson County, and Ottawa County.
Oklahoma: Garvin County.
Oregon: Klamath County.
Pennsylvania: Lancaster County, Montour County, Northumberland County, Snyder County, and Union County.
South Carolina: Aiken County.
Texas: Coryell County.
Virginia: Prince George County.

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